

NATIONAL INSTITUTE FOR ROCKET PROPULSION SYSTEMS

NIRPS: An Overview JANNAF May 2, 2013

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#### NIRPS: Where we started

- Sept 16, 2011 letter signed by NASA Administrator Bolden authorized creation of NIRPS
- Letter recommended three focus areas
- Established MSFC as NASA lead, in cooperation with Department of the Air Force and the National Reconnaissance Office

National Aeronautics and Space Administration

Office of the Administrator Washington, DC 20546-0001

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TO: Officials-in-Charge of Hosequarters Offices

Directors, NASA Centers

FROM: Administrator

SUBJECT: Intent to Establish a National Institute for Rocket Propulsion System

Last October, the Secretary of the Air Force, the Director of the National Reconstituent collaborate in multiple areas including the development of a coherent Government strategy aimed at personning our Nation's rocket propulsion industrial base. Over the past several months, representatives from each of these organizations have bad the opportunity to discuss areas of motal interest as outlined in the Letter of Interst. While still ongoing, these discussions have identified the need for a recognized entity to serve as the Nation's integration point for matters pertaining to rocket propulsion systems.

Fundamentally, it is envisioned that the mission of this organization will be to help preserve and align Government and private necket propulsion capabilities to meet present and fature U.S. constructed, civil, and defense space needs, while providing authoritative insight and recommendations to national decisional authorities. To accomplish this mission, specific offers of the proposed organization may include the following:

- Menitoring and analyzing the state of the industry in order to inform policy leaders on
  options and strategies that promote a healthy industrial base and ensure best-value for the
  American taxonies.
- Identifying technology needs and recommending technology insertions by leading readmap assessments and activity participating in program formulation activities.
- Maintaining relationships and awareness across the industry to match requirement holders with the most relevant solution approach.

In order to support this need, I have asked the Murshall Space Flight Center Director, Mr. Robert Lightfow, to lead this Agency's efforts in the joint definition and establishment of a National Institute for Rocket Propulsion Systems in cooperation with the Department of the Air Force and the National Reconnaissance Office.

It is my belief that this institute will be a strategic asset that better prepares NASA and other. Government agencies to plan and nurture future national propulsion needs and consens that commercial industry is ready to falful those needs. Your support and cooperation with Mr. Lightfoot and his staff regarding this matter are greatly appreciated.



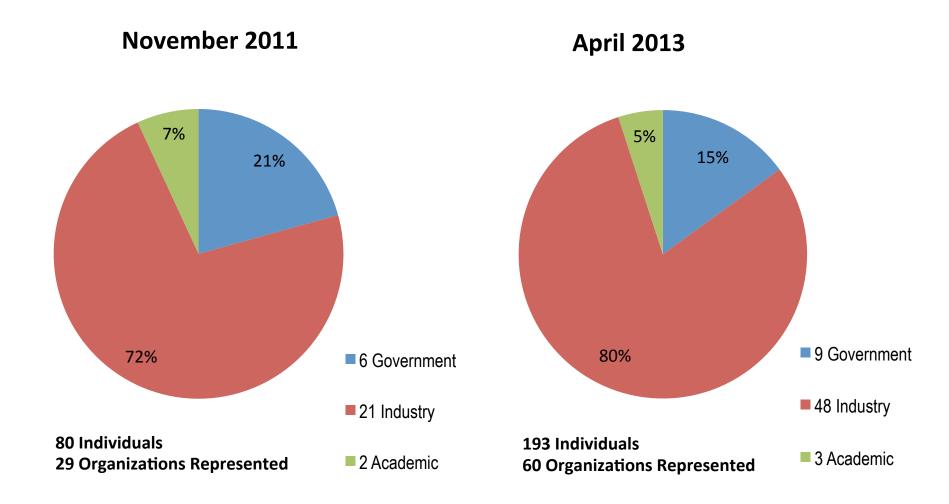


### **Building the Foundation**

- Identified key concerns of the propulsion community
- Developed and verified Grand Challenges & allocated primary/secondary responsibilities to NIRPS Strategy Teams
- Established NIRPS Strategy Teams with broad membership
- Developed strategies to meet Grand Challenges
- Established monthly NIRPS Planning Team meeting with government, industry, and academic participation
- Executing High Priority Tasks
  - SLS propulsion supply chain analysis
  - Collaborative Portal and Skills and Capabilities Database
  - Integrated Propulsion Technology Roadmaps
- Forums Supported: Von Braun Symposium, Space Transportation Policy Workshop, JANNAF Plenary Session, National Defense Industrial Association, Space Trans. Assoc. Breakfast, JPC, SMDC, Marshall Association
- Held JANNAF/NIRPS Annual Workshop



## NIRPS: Building a National Capability





#### NIRPS: An Enabler for America's Space Efforts

Academic Partners



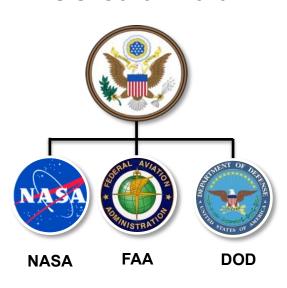


Commercial Space





U.S. Government



## N.RPS

#### Fostering...

a vibrant rocket propulsion community that provides reliable and affordable propulsion systems in support of the nation's defense, civil and commercial needs.



## **Derivation of the Grand Challenges**

Lack of integrated space Lack of defined space missions Lack of multi-Agency vision strategies across Government Lack of Agencies and Departments predictable long-term Collaborate across Frequent program funding starts & cancellations Agencies Reduce development & Shuttle retirement sustainment costs Implement an integrated Uncertainty, Aging Foster access to facilities science & technology in future work needs & expertise force plan Industrial Support industrial base base decline Invigorate the competitiveness & Lack of Overcapacity of STEM pipeline sustained resilience production technology capability development Rising Fewer engineers have Difficulty in access to technology development supplier government facilities costs experience Loss of competitiveness in the global market Large solid rocket Overall decline in aerospace motor industrial base Systems infrastructure, supply chain, engineer demand & skill base challenges decline



#### **Accomplishments Addressing the Grand Challenges**

## Support competitiveness of IB

- •Analyzing data from industry and government to develop a snapshot of U.S. rocket propulsion industrial base health
- •Developing supply chain analysis methods to support SLS architecture decisions and determine effects of decisions on industrial base

## Invigorate STEM Pipeline

- •Supported continued development and university utilization of the MSFC Generalized Fluid System Simulation Program (GFSSP)
- •Planning academic workshop to solicit inputs from academic community on NIRPS activities and strategic plan

# Develop integrated S&T plan

- •Leading interagency task team responding to NDAA 2011 Sec. 1095 action to develop national rocket propulsion strategy
- •NIRPS and AFRL working to integrate NASA roadmaps with IHPRPT roadmaps

#### Reduce development and sustainment costs

 Supported NASA/DoD ammonium perchlorate collaborative procurement

# Collaborate across agencies

- •Initiated crosscommunity skills, capabilities, and subject matter expert directory, and web tool
- Acquired CPIAC Support for Skills & Capabilities directory/ web tool
- Supported negotiations with USAF on AUSEP & AKE collaboration
- Performed additional study requested by OSTP on national altitude test capability

# Foster access across IB

•Developing strategies for easier access to US government facilities & expertise in partnership with Defense Acquisition University



#### Support Competitiveness of Industrial Base

#### **Industrial Base Health Metrics**

- Objective: develop useful metrics that can serve as indicators of the the overall health of the Propulsion Industrial Base
- Developed survey to collect data for Industrial Base Health Metrics
  - Released: 22 October 2012
  - Input Deadline: 22 January 2013
- Input from a variety of organizations
  - Integrators
  - Propulsion Suppliers
  - Component and material suppliers
  - US Government Organizations
- Data is currently being analyzed, will be published as an AIAA paper, Fall 2013.
- Will be compared with Department of Commerce data for validation



### Support Competitiveness of Industrial Base

#### **SLS Supply Chain Analysis**

- Objective: Inform Agency Decision makers of the impacts to the Propulsion Industrial Base, due to potential SLS architecture decisions
- NIRPS and Aerospace Corporation to execute in conjunction with HEOMD, SLS (Engines and Booster Offices)
- Additional Partners: Defense Contracts Management Agency (DCMA), Defense Acquisition University (DAU) and Department of Commerce (DoC)
- Stakeholders: NASA, Office of the Secretary of Defense (OSD), US Navy Strategic Programs, USAF PEO, Space Launch
- Primary Tasks (Phase 1)
  - Evaluate the current and planned DoD expenditures for DDT&E, production, and operations for propulsion systems of current and future expendable launch vehicles
  - Provide subject matter expertise to provide an estimate of how SLS funding could affect the industrial base
  - Develop an approach to produce and analyze multi-layer supply chain maps for SLS rocket engines
  - SLS core uses existing RS-25Ds and (later) RS-25E expendable variants
  - Period of Performance(first phase): March 2013- August 2013 (approx. 20 weeks)



### **Invigorate STEM Pipeline**

#### **Academic Workshop**

- Objective: to provide a forum to solicit input from the academic community on NIRPS
  - Progress to date
  - Strategic Plan
  - Engagement with the academic community
  - Revalidation of the grand challenges
- Location: UA Huntsville
- Date: In conjunction with the 7<sup>th</sup> Wernher von Braun Memorial Symposium 7-9 October 2013
- Membership: UA Huntsville will coordinate membership. Bob Fredrick and Tom Koshut will lead effort



### **Develop Integrated S&T Plan**

#### **NDAA Sec. 1095**

- (a) SENSE OF THE CONGRESS.-It is the sense of Congress that the sustainment of the solid rocket motor and liquid rocket engine industrial base is a national challenge that spans multiple departments and agencies of the Federal Government and requires the attention of the President.
- (b) STRATEGY REQUIRED.
  - (1) IN GENERAL.-Not later than 180 days after the date of the enactment of this Act, the President shall transmit to the appropriate congressional committees a **national rocket propulsion strategy for the United States**, including-
    - (A) a description and assessment of the effects to programs of the Department of Defense and intelligence community that rely on the solid rocket motor and liquid rocket engine industrial base caused by the end of the Space Shuttle program and termination of the Constellation program;
    - (B) a description of the plans of the President, the Secretary of Defense, the intelligence community, and the Administrator of the National Aeronautics and Space Administration to mitigate the impact of the end of the Space Shuttle program and termination of the Constellation program on the solid rocket motor and liquid rocket engine propulsion industrial base of the United States;
    - (C) a consolidated plan that outlines key decision points for the current and next-generation mission requirements of the United States with respect to tactical and strategic missiles, missile defense interceptors, targets, and satellite and human spaceflight launch vehicles;
    - (D) **options and recommendations** for synchronizing plans, programs, and budgets for research and development, procurement, operations, and workforce among the appropriate departments and agencies of the Federal Government to strengthen the solid rocket motor and liquid rocket engine propulsion industrial base of the United States; and
    - (E) any other relevant the President considers necessary

NIRPS assigned leadership responsibility by OSTP to address the National Rocket Propulsion Strategy



S. 1867

### NDAA Sec. 1095: Background

- Many previous studies and reports, and results are still valid. Six key needs are:
  - Competiveness and resilience of the propulsion industrial base
  - An integrated science and technology plan
  - Better collaboration across agencies for propulsion systems development
  - Better and easier access to government facilities and expertise
  - Revitalized Science, Technology, Engineering and Mathematics (STEM) pipeline
  - Reduction of development and sustainment cost for propulsion components and systems
- Rocket propulsion is a key subsystem used to provide a necessary capability.
  - i.e. space launch, munitions delivery, etc.
- Rocket propulsion has evolved since the 1940s, but it remains a highly specialized field that relies significantly upon experience and heritage.
  - Some areas not fully understood and small perturbations have unintended results.
  - Aging of the workforce is a significant issue, with regard to maintaining safety and mission assurance.
  - Industry consolidation has reduced the number of companies serving the same market.



## NDAA Sec. 1095 Accomplishments/Status

- Team gathered and summarized data
  - Defined Rocket Propulsion Industry Base and the Desired End State
  - Formed 6 integration categories
  - Drew on SRM and LRE 2011 Studies, Dept. of Commerce 2010 survey
- Senior Steering Group (SSG) has held seven meetings with Inter Agency Task Team to provide guidance to the team
- Team held two Face-to-Face Workshops
  - Army, Air Force, Navy, MDA, OSD, NASA, and FAA were all represented
- Delivery of final report to OSTP completed January 2013
- Follow on action from OSTP, to evaluate courses of action and develop an recommended implementation plan
- Established Inter-Agency Task Team to develop implementation plan
- Performed additional study requested by OSTP on national altitude test capability



### Develop integrated S&T plan

# Integrated High Payoff Rocket Propulsion Technology (IHPRPT) Steering Committee Meeting April 23-24 at Edwards AFB

- Much interest in MSFC Additive Manufacturing and Structured Light for propulsion
- MSFC supporting AF Risk Reduction re. Hydrocarbon Boost Demo Program
- AF interest in F-1 GG testing
- AF Solid Rocket Modeling tool development useful to MSFC analysts
- AFRL Plasma Modeling work of interest to MSFC Electric Propulsion group
- AF Solid Propulsion Aging and Surveillance work applicable to NASA SRB work and composite case and CIF work on electrically controlled solids
- Several informal MSFC/AFRL discussions re. collaboration
- Planning meeting to discuss mapping NASA and IHPRPT Roadmaps
- Inputting NASA technology to IHPRPT GOTChA process



#### **Collaborate and Foster Access**

- NIRPS will maintain relationships and awareness across the Government, industry and academia, to align available capacity with emerging demand
- Key activities
  - Develop interactive web based collaborative tool for use across the propulsion community
  - Support strategy and execution of the next JANNAF/NIRPS technical execution contract
  - Support ongoing development efforts across the propulsion community



## Reduce development, sustainment costs

#### **Coordinated AP Buy**

- Ammonium perchlorate (AP)
   used by every armed service
   and many commercial firms
- Historical decline in demand for ammonium perchlorate, increasing costs and threatening remaining domestic supplier
- NIRPS facilitated coordination between government users in early 2012, stabilizing demand, production, and pricing.



 NIRPS AP Team presented Technical Achievement Award from the Air, Space and Missile Defense Association Jan. 25, 2012



## NIRPS FY13 Goals

Grand Challenges	FY13 Goals	Team	Stat
Support the Competitiveness and resilience of the industrial Base	1.1 Develop Supply Chain Analysis for SLS Architecture Decisions.	Stewardship	
	1.2 Develop Metrics to Determine Health of Industrial Base.	Stewardship	
2. Invigorate the STEM pipeline	2.1 Provide engineering students with practical experience utilizing propulsion design and analysis tools and methodologies.	Solutions Facilitator	
Develop and integrate a science and technology plan for propulsion systems	3.1 Use existing roadmaps to identify opportunities for collaborations and leveraging of complimentary activities.	Technology	
4. Reduce development and sustainment costs for missiles and rocket systems	4.1 Conduct a study/survey of low cost technology test beds and/or other methods for transitioning propulsion component /sub-system technologies through the TRL valley of death (TRL 4-6).	Technology	
5. Collaborate across agencies for missile and rocket propulsion system development	5.1 Develop initial community of interest capability.  It	Solutions Facilitator	
	5.2 Establish a Cross-Cutting Collaborative Solutions Team that executes tasks of cross community interest, stimulating potential follow-on collaborations.	Solutions Facilitator	
6. Foster access to facilities and expertise across Government, industry, and academia	6.1 Develop initial Propulsion Skills and Capabilities Directory & Web Tool.	Solutions Facilitator	
	6.2 Complete study of mechanisms for potential pass through process to ease access to cross government skills and capabilities.	Solutions Facilitator	
Integrated Goals Integrated Goals	IG.1 Develop operational model defining management concepts, operating principles and framework, and high-level goals including a concept of management oversight	Integrated	
	for periodic evaluation.  IG.2 Develop a comprehensive Strategic Communications Plan that addresses external and internal stakeholders, interactive websites, and outreach planning for public, STEM, and Agency/Industry engagement.	Integrated	
	IG.3 Establish a National Charter IG.4 NDAA 1095 Follow-on Activity	Integrated Integrated	
Llava not started			

Have not started

On Plan

**Known Issues** 



### Looking Ahead: Reviews and Workshops

Intergovernmental Red Team Industry Workshop Academic Workshop

Aug 2013

In Conjunction with Space And Missile Defense Conference (SMDC 2013)

- Huntsville, AL
- Senior Level Government Executives from NIRPS partners (Services, MDA, OSD, etc)

Sep 2013

- In Conjunction with AIAA Space 2013
- San Diego, CA
- Executive Leadership from industry Partners

Oct 2013

- In Conjunction with Von Braun Memorial Symposium
  - University of Alabama: Huntsville
  - Senior Academic Personell

#### Areas of Interest

- National Strategy Implications of NIRPS/1095
- b) Roles of Government/Industry/ Academia
- c) Governance Structure
- d) Long Term Strategy
- e) Course Correction

#### Areas of Interest

- a) Industry Health and competitiveness
- b) NIRPS Collaboration with Industry
- c) Long Term Strategy
- d) Course Correction

#### Execution

- a) Academic Concerns and Engagement
- b) Long Term Strategy
- c) Revalidation of Grand Challenges
- d) Course Correction



## Looking Forward: Challenges, Opportunities

# FY 2013 is a year of consolidation and execution Pivot from organizational formulation to adding real value to the Propulsion Community

#### **Strategic Needs**

- Formalize agreements with other US Government Agencies
- Determine Interim and End States of NIRPS
- Respond and react to NDAA Sec. 1095 Outcomes
- Develop STEM Strategy and execution plan
- Effectively Communicate the value and accomplishments of NIRPS across the Agency, Government and Propulsion Community

#### **Execution Priorities**

- Use NIRPS Metrics and DoC data to develop a "State of the Propulsion Industry" report/dashboard
- Develop Supply Chain Analysis capabilities to inform SLS and other major architecture decisions
- Complete initial Integrated Propulsion Science and Technology Roadmap in conjunction with IHPRPT (RP21)
- Build initial collaborative capability across the Propulsion Ecosystem and ease access to NASA facilities, skills and personnel

#### Challenges

- Effective integration and Coordination with other Government Agencies
- Continued Active engagement with Industry and Academia
- Building an Efficient and Responsive Governance System for a growing Institute



## Summary

- The NIRPS Mission
- Addressing the Grand Challenges
- Executing Tasks of National Importance
- Building our Capabilities
- Adding Value to the Propulsion Ecosystem



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http://nirps.msfc.nasa.gov/home



#### Questions



